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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/587,268

07/26/2006

Hiroaki Takaiwa

128865

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25944 7590 02/20/2009

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P.O. BOX 320850

ALEXANDRIA, VA 22320-4850

EXAMINER

LIU, MICHAEL

ART UNIT

PAPER NUMBER

2851

MAIL DATE

DELIVERY MODE

02/20/2009

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/587,268	<b>Applicant(s)</b> TAKAIWA ET AL.	
	<b>Examiner</b> Michael Liu	<b>Art Unit</b> 2851	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 16 December 2008.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-51 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 36-47, 50 and 51 is/are allowed.
- 6) ☒ Claim(s) 1, 2, 4-14, 18-27, 34, 35, 48 and 49 is/are rejected.
- 7) ☒ Claim(s) 3, 15-17 and 28-33 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |   |   |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date <u>7/16/08, 8/28/08</u> | 6) <input type="checkbox"/> Other: _____  |

### **DETAILED ACTION**

1. Receipt is acknowledged of the Amendment filed on 12/16/08. By this amendment, claims 1-51 have been amended.

#### ***Information Disclosure Statement***

2. The submissions of the foreign references have been received and considered, and accordingly, the objection to the IDS is withdrawn.
3. Due to the excessively lengthy Information Disclosure Statement submitted by applicant, the examiner has given only a cursory review of the listed references. In accordance with MPEP 609.04(a), applicant is encouraged to provide a concise explanation of why the information is being submitted and how it is understood to be relevant. Concise explanations (especially those which point out the relevant pages and lines) are helpful to the Office, particularly where documents are lengthy and complex and applicant is aware of a section that is highly relevant to patentability or where a large number of documents are submitted and applicant is aware that one or more are highly relevant to patentability. Applicant is required to comply with this statement for any non-English language documents. See 37 CFR § 1.56 Duty to Disclose Information Material to Patentability.

#### ***Specification***

4. The amendment to the title has been considered, and as a result, the objection to the specification is withdrawn.

***Claim Rejections - 35 USC § 112***

5. Claim 1 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The support for the newly added claim limitation “at a time when the exposure light is emitted onto the substrate” is not found in the specification or the drawings. Detection is done before and after exposure but not at a time when the exposure light is emitted onto the substrate.

***Double Patenting***

6. The amendments to claim 1 have been considered, and accordingly, the double patenting rejection is withdrawn.

***Claim Rejections - 35 USC § 102***

7. Despite the claim amendments, the Mulkens reference is maintained for the claim rejections. The Takahashi reference has been changed to a 103 rejection.

8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

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9. Claims 1, 2, 4-14, 19, and 22 are rejected under 35 U.S.C. 102(e) as being anticipated by Mulkens et al (US 2005/0132914).

Note: With respect to claim 1, the preamble reciting intended use, e.g., "that exposes a substrate by emitting exposure light onto the substrate through a projection optical system and a liquid," is not given patentable weight. In apparatus, article, and composition claims, intended use language must result in a structural difference to patentably distinguish over the prior art. See MPEP § 2111.02, 2112, & *In re Schreiber*, 44 USPQ2d 1429 (Fed Cir 1997).

**Re claim 1:** Mulkens discloses an exposure apparatus [Fig 4] comprising:

a detection apparatus 22 that detects whether a liquid is present on an object WT [Par 0105: "As shown in Fig 4, a detector 22 detects the presence or absence of immersion liquid present on the substrate W."] that is disposed lower than a front end of the projection optical system PL [Fig 10] at a time when the exposure light [Par 0105: low intensity electromagnetic waves] is emitted onto the substrate W.

**Re claim 2:** the detection apparatus 22 has an emitting portion [Par 0105: emits low intensity electromagnetic waves] that emits detection light and a light receiving portion [detects EM waves].

**Re claim 4:** the detection is performed while relatively moving the detection light and the object. [Fig 4: It is inherent that the detection light, which is comprised of EM waves, relatively moves with respect to the object WT while the detection is performed by detector 22. The EM waves clearly move relative to the substrate table WT to strike and reflect off of the table.]

**Re claim 5:** the object WT is movable [Par 0099: via second positioning device PW] with respect to the projection optical system PL.

**Re claim 6:** the object includes at least one of the substrate, a substrate stage WT that is movable [via PW] and holds the substrate W [Fig 2], and a member provided on the substrate stage.

**Re claim 7:** a bending portion that bends an optical path of the detection light. [Fig 10: The immersion liquid present on the substrate W inherently bends an optical path of the detection light, since it has a different refractive index.]

**Re claim 8:** the detection light is emitted substantially parallel to a surface of the object WT. [Fig 2: The substrate table WT has multiple surfaces, which includes the vertical surface in the Z direction. This vertical surface of WT is parallel to the detection light.]

**Re claim 9:** whether the liquid is present in an optical path of the detection light is determined based on a light receiving result of the light receiving portion. [Par 0105: “In this example, the detector 22 detects the presence of liquid on the substrate W by the reflection of low intensity electromagnetic waves.”]

**Re claim 10:** the detection light passes through an area away from the surface of the object WT by less than 5.5 mm. [Detection light strikes the surface of the substrate table WT, which means the detection light is less than 5.5 mm from the surface of WT.]

**Re claim 11:** a position of the liquid on the object WT is obtained based on a light receiving result of the light receiving portion 22. [Fig 10 and Par 0105: When the

detector 22 detects the presence of immersion liquid on substrate table WT, the position of the liquid is inherently determined.]

**Re claim 12:** the emitting portion emits the detection light to a space [Fig 4: below detector 22] between the projection optical system PL and the object WT [Fig 4].

**Re claim 13:** the emitting portion emits the detection light to a surface of the object WT [Fig 4 and Par 0105].

**Re claim 14:** the light receiving portion receives light from the surface of the object, and the liquid on the surface of the object can be detected based on the light receiving result. [Par 0105: "In this example, the detector 22 detects the presence of liquid on the substrate W by the reflection of low intensity electromagnetic waves."]

**Re claim 19:** the detection light includes a sheet light flux [inherent that EM waves have sheet light flux].

**Re claim 22:** an exposure operation is controlled based on a detection result of the detection apparatus. [Par 0105: "Based on the measurement of detector 22, the controller 21 determines which one or more optical elements 9, 10, 11, 12 is/are necessary. The controller can determine which one or more of optical elements 9, 10, 11 and 12 can ensure that the projection beam PB is accurately focused on the upper substrate surface."]

### ***Claim Rejections - 35 USC § 103***

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

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invention was made to a person having ordinary skill in the art to which the subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

11. Claims 18, 24-27, 34, 35, 48, and 49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mulkens.

**Re claim 24:** Mulkens discloses an exposure apparatus [Fig 1] that exposes a substrate W by emitting exposure light PB onto the substrate through a projection optical system PL and a liquid [Fig 10], the exposure apparatus comprising:

a liquid supply system [Fig 2] having a supply port IN, which supplies the liquid such that the liquid covers only a portion of a surface of the substrate W at a time when the exposure light is emitted onto the substrate [Fig 2]; and

a detection apparatus 22 having a light receiving portion [Par 0105: detects low intensity electromagnetic waves], wherein an immersion area [Fig 10] is formed between the projection optical system and an object WT disposed on an image plane side of the projection optical system.

Mulkens does not disclose expressly the detection apparatus obtains at least one of a size and a shape of an immersion area in a direction perpendicular to an optical axis of the projection optical system, based on a light receiving result of the light receiving portion.

However, Mulkens adds in Par 0105, "Additionally or alternatively, the detector 22 can determine the quantity of immersion liquid present." The detector 22 can determine the quantity, or the size, of the liquid. The quantity of the liquid comprises a volume, wherein every volume consists of three dimensions. The three dimensions are in the X, Y, and Z directions, of which the X and Y directions are perpendicular to an



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optical axis in the Z direction. Therefore, the detector determines a size of an immersion area in a direction perpendicular to an optical axis, based on a light receiving result of the light receiving portion.

At the time the invention was made, it would have been obvious to one of ordinary skill in the art to recognize that the invention of Mulkens teaches obtaining a size of an immersion area in a direction perpendicular to an optical axis, for the purpose of selecting the appropriate optical element(s) in order to accurately focus the projection beam on the substrate [Par 0105].

**Re claim 25:** the detection apparatus 22 includes an emitting portion [Par 0105: emits EM waves] that emits detection light, and at least one of the size [quantity] and the shape of the immersion area is obtained based on the light receiving result of the detection light.

**Re claim 26:** a detection by the detection apparatus is performed in parallel with the exposure of the substrate. [Fig 4: Both detection and exposure occur in parallel in the Z direction.]

**Re claim 27:** the detection apparatus 22 includes an emitting portion [Par 0105: emits EM waves] that emits detection light, and the detection light is emitted to the vicinity of an edge portion of the immersion area [Fig 10].

**Re claims 18 and 34:** Mulkens teaches all limitations of the claimed invention except for the detection light being infrared light.

However, Mulkens teaches detecting liquid using low intensity EM waves [Par 0105]. Since it is known that infrared light propagates at low intensity relative on the

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light spectrum, infrared light can be reasonably interpreted to be low intensity EM waves.

At the time the invention was made, it would have been obvious to one of ordinary skill in the art to recognize that infrared light is equivalent to low intensity EM waves and can be used as the detection light of Mulkens, for the purpose of accurately detecting the presence of immersion liquid to achieve quality exposure.

**Re claim 35:** the detection apparatus 22 includes an emitting portion [Par 0105: emits EM waves] that emits detection light, and the detection light includes a sheet light flux [inherent that EM waves have sheet light flux].

**Re claim 48:** A device manufacturing method comprising:

exposing a substrate W through the projection optical system PL of the exposure apparatus [Fig 4] according to Claim 1; and

processing the exposed substrate [Par 0072].

**Re claim 49:** A device manufacturing method comprising:

exposing a substrate W through the projection optical system PL of the exposure apparatus [Fig 1] according to Claim 24; and

processing the exposed substrate [Par 0072].

12. Claims 1, 20-23, and 48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takahashi (US 5,610,683).

**Re claim 1:** Takahashi discloses an exposure apparatus [Fig 1] that exposes a substrate 2 by emitting exposure light [from illumination optical system 3] onto the

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substrate through a projection optical system 4 and a liquid 23, the exposure apparatus comprising:

a detection apparatus 801 that detects whether a liquid is present on an object 601 [C8L50-52: "In Fig 8, denoted at 801 is a liquid level gauge for measuring the level of liquid 23 in the cassette 9."] that is disposed lower than a front end 7 of the projection optical system [Fig 8].

Takahashi does not disclose expressly that the detection apparatus detects at a time when the exposure light is emitted onto the substrate.

However, at the time the invention was made, it would have been obvious to one of ordinary skill in the art to have the liquid level gauge of Takahashi perform detection during exposure, for the purpose of ensuring satisfactory liquid levels during exposure in order to achieve desired patterns.

**Re claim 20:** a liquid supply system [Fig 8: piping system with circulation pump 20] having a supply port [pipe from filter 21] that supplies the liquid; and

a liquid recovery system [piping system] having a recovery port [pipe to circulation pump 20] that recovers the liquid;

wherein an operation of at least one of the liquid supply system and the liquid recovery system is controlled based on a detection result of the detection apparatus.

[C9L6-8: "When the liquid 23 of a predetermined quantity is fed, this is detected by the liquid level gauge 801 and the pump 20 is stopped."]

**Re claim 21:** the supply of the liquid by the liquid supply system is stopped if it is determined that the detection result of the detection apparatus 801 is abnormal. [C9L6-

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8: The pump 20 is stopped if it is determined that the detection result of the liquid level gauge 801 is at a threshold stage, which is defined as a predetermined quantity of the liquid 23 fed into the cassette 9. In this case, the detection result being abnormal is defined as the liquid level gauge 801 detecting the liquid reaching the threshold stage.]

**Re claim 22:** an exposure operation is controlled based on a detection result of the detection apparatus 801. [C9L6-8: The amount of the liquid 23 used, which is a predetermined quantity, in the exposure operation is controlled based a detection result of the liquid level gauge 801.]

**Re claim 23:** a warning is issued if it is determined that a detection result of the detection apparatus is abnormal. [C9L6-8: The pump 20 is stopped if it is determined that the detection result of the liquid level gauge 801 is at a threshold stage, which is defined as a predetermined quantity of the liquid 23 fed into the cassette 9. In this case, the detection result being abnormal is defined as the liquid level gauge 801 detecting the liquid reaching the threshold stage. Once the detection result is abnormal, the liquid level gauge clearly sends a warning signal to the pump to stop in order to prevent more liquid being pumped into the cassette.]

**Re claim 48:** A device manufacturing method comprising:  
exposing a substrate 2 through the projection optical system 4 of the exposure apparatus [Fig 1] according to Claim 1; and  
processing the exposed substrate [at post-processing station 36].

***Allowable Subject Matter***

13. Claims 3, 15-17, and 28-33 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

14. Claims 36-47, 50, and 51 are allowed.

15. The following is a statement of reasons for the indication of allowable subject matter:

**Re claim 3:** There is no prior art that discloses, in combination with all the other claimed limitations, the detection light is emitted from the emitting portion to a plurality of positions.

**Re claim 15 (and dependent claims 16 and 17):** There is no prior art that discloses, in combination with all the other claimed limitations, the surface of the object includes a recessed portion formed on the object.

**Re claim 28 (29, 30):** There is no prior art that discloses, in combination with all the other claimed limitations, the detection light is emitted to each of a plurality of positions in the vicinity of an edge portion of the immersion area.

**Re claim 31 (32, 33):** There is no prior art that discloses, in combination with all the other claimed limitations, wherein an operation of at least one of the liquid supply system and the liquid recovery system is controlled based on a detection result of the detection apparatus.

**Re claim 36 (37-41, 50):** There is no prior art that discloses, in combination with all the other claimed limitations, a shape detection apparatus that obtains a shape of the liquid on an object.

**Re claim 42 (43-47 and 51):** There is no prior art that discloses, in combination with all the other claimed limitations, a detection apparatus that detects a contact angle of the liquid.

### ***Response to Arguments***

16. Applicant's arguments with respect to Mulkens have been fully considered but they are not persuasive. In reference to claim 1, Applicant argues that Mulkens fails to disclose a detection apparatus that performs detection at a time when the exposure light is emitted onto the substrate [P16L1-3]. The examiner respectfully disagrees. The intended use language utilized in claim 1, e.g., "that exposes a substrate by emitting exposure light onto the substrate through a projection optical system and a liquid," does not result in a structural difference to patentably distinguish over the prior art. As a result, the preamble reciting intended use has not been given patentable weight. Consequently, the exposure light in claim 1 can be met by the low intensity EM waves of the detector of Mulkens. Therefore, the Mulkens reference can be reasonably interpreted to teach the claim limitations of claim 1.

In reference to claim 24, Applicant contends that Mulkens fails to disclose a detection apparatus that obtains at least one of a size and a shape of an immersion area in a direction perpendicular to an optical axis of the projection optical system [P16L13-15]. The examiner respectfully disagrees. The detector 22 can determine the

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quantity, or the size, of the liquid. The quantity of the liquid comprises a volume, wherein every volume consists of three dimensions. The three dimensions are in the X, Y, and Z directions, of which the X and Y directions are perpendicular to an optical axis in the Z direction. Therefore, the detector of Mulkens determines a size of an immersion area in a direction perpendicular to an optical axis, based on a light receiving result of the light receiving portion, teaching the claim limitations of claim 24.

17. Applicant's arguments with respect to Takahashi have been fully considered but they are not persuasive. Applicant contests that Takahashi fails to disclose a detection apparatus that performs detection at a time when the exposure light is emitted onto the substrate [P16L24-25]. The examiner respectfully disagrees. The liquid level gauge 801 of Takahashi is utilized to control the quantity of liquid 23 that is fed into the cassette 9. When the liquid 23 of a predetermined quantity is fed, this is detected by the liquid level gauge 801 and the pump 20 is stopped [C9L6-8]. It would have been obvious to have the liquid level gauge be continuously operated to detect the level of the liquid, including during exposure. This is done to ensure that the liquid level remains satisfactory during exposure. Additionally, the disclosure of Takahashi teaches the pump 20 being stopped, but not the detection by the liquid level gauge. Therefore, it would have been obvious to have the liquid level gauge of Takahashi continue detection during exposure.

### ***Conclusion***

18. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP

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§ 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

19. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael Liu whose telephone number is 571-272-9019. The examiner can normally be reached on Monday through Friday 9 am - 5 pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Diane Lee can be reached on 571-272-2399. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

/Michael Liu/

ML 2/13/09

Michael Liu  
Examiner  
Art Unit 2851

/Diane I Lee/

Supervisory Patent Examiner, Art Unit 2851